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# Python: Code Challenges (Optional)

## or Operator

The Python `or` operator combines two Boolean expressions and evaluates to `True` if at least one of the expressions returns `True`. Otherwise, if both expressions are `False`, then the entire expression evaluates to `False`.

```
True or True      # Evaluates to True
True or False     # Evaluates to True
False or False    # Evaluates to False
1 < 2 or 3 < 1    # Evaluates to True
3 < 1 or 1 > 6    # Evaluates to False
1 == 1 or 1 < 2   # Evaluates to True
```

## Comparison Operators

In Python, *relational operators* compare two values or expressions. The most common ones are:

- `<` less than
- `>` greater than
- `<=` less than or equal to
- `>=` greater than or equal too

If the relation is sound, then the entire expression will evaluate to `True`. If not, the expression evaluates to `False`.

```
a = 2
b = 3
a < b  # evaluates to True
a > b  # evaluates to False
a >= b # evaluates to False
a <= b # evaluates to True
a <= a # evaluates to True
```

## `if` Statement

The Python `if` statement is used to determine the execution of code based on the evaluation of a Boolean expression.

- If the `if` statement expression evaluates to `True`, then the indented code following the statement is executed.
- If the expression evaluates to `False` then the indented code following the `if` statement is skipped and the program executes the next line of code which is indented at the same level as the `if` statement.

```
# if Statement

test_value = 100

if test_value > 1:
  # Expression evaluates to True
  print("This code is executed!")

if test_value > 1000:
  # Expression evaluates to False
  print("This code is NOT executed!")

print("Program continues at this point.")
```

## `else` Statement

The Python `else` statement provides alternate code to execute if the expression in an `if` statement evaluates to `False`.
The indented code for the `if` statement is executed if the expression evaluates to `True`. The indented code immediately following the `else` is executed only if the expression evaluates to `False`. To mark the end of the `else` block, the code must be unindented to the same level as the starting `if` line.

```
# else Statement

test_value = 50

if test_value < 1:
  print("Value is < 1")
else:
  print("Value is >= 1")

test_string = "VALID"

if test_string == "NOT_VALID":
  print("String equals NOT_VALID")
else:
  print("String equals something else!")
```

## `and` Operator

The Python `and` operator performs a Boolean comparison between two Boolean values, variables, or expressions. If both sides of the operator evaluate to `True` then the `and` operator returns `True`. If either side (or both sides) evaluates to `False`, then the `and` operator returns `False`. A non-Boolean value (or variable that stores a value) will always evaluate to `True` when used with the `and` operator.

```
True and True      # Evaluates to True
True and False     # Evaluates to False
False and False    # Evaluates to False
1 == 1 and 1 < 2   # Evaluates to True
1 < 2 and 3 < 1    # Evaluates to False
"Yes" and 100      # Evaluates to True
```

## `elif` Statement

The Python `elif` statement allows for continued checks to be performed after an initial `if` statement. An `elif` statement differs from the `else` statement because another expression is provided to be checked, just as with the initial `if` statement.
If the expression is `True`, the indented code following the `elif` is executed. If the expression evaluates to `False`, the code can continue to an optional `else` statement. Multiple `elif` statements can be used following an initial `if` to perform a series of checks. Once an `elif` expression evaluates to `True`, no further `elif` statements are executed.

```
# elif Statement

pet_type = "fish"

if pet_type == "dog":
  print("You have a dog.")
elif pet_type == "cat":
  print("You have a cat.")
elif pet_type == "fish":
  # this is performed
  print("You have a fish")
else:
  print("Not sure!")
```

## Equal Operator ==

The equal operator, `==`, is used to compare two values, variables or expressions to determine if they are the same.
If the values being compared are the same, the operator returns `True`, otherwise it returns `False`.
The operator takes the data type into account when making the comparison, so a string value of `"2"` is *not* considered the same as a numeric value of `2`.

```
# Equal operator

if 'Yes' == 'Yes':
  # evaluates to True
  print('They are equal')

if (2 > 1) == (5 < 10):
  # evaluates to True
  print('Both expressions give the same
result')

c = '2'
d = 2

if c == d:
  print('They are equal')
else:
  print('They are not equal')
```

## Not Equals Operator !=

The Python not equals operator, `!=`, is used to compare two values, variables or expressions to determine if they are NOT the same. If they are NOT the same, the operator returns `True`. If they are the same, then it returns `False`.
The operator takes the data type into account when making the comparison so a value of `10` would NOT be equal to the string value `"10"` and the operator would return `True`. If expressions are used, then they are evaluated to a value of `True` or `False` before the comparison is made by the operator.

```
# Not Equals Operator

if "Yes" != "No":
  # evaluates to True
  print("They are NOT equal")

val1 = 10
val2 = 20

if val1 != val2:
  print("They are NOT equal")

if (10 > 1) != (10 > 1000):
  # True != False
  print("They are NOT equal")
```

## List Method `.count()`

The `.count()` Python list method searches a list for whatever search term it receives as an argument, then returns the number of matching entries found.

```
backpack = ['pencil', 'pen', 'notebook',
'textbook', 'pen', 'highlighter', 'pen']
numPen = backpack.count('pen')

print(numPen)
# Output: 3
```

## Adding Lists Together

In Python, lists can be added to each other using the plus symbol `+`. As shown in the code block, this will result in a new list containing the same items in the same order with the first list's items coming first.
**Note:** This will not work for adding one item at a time (use `.append()` method). In order to add one item, create a new list with a single value and then use the plus symbol to add the list.

```
items = ['cake', 'cookie', 'bread']
total_items = items + ['biscuit', 'tart']
print(total_items)
# Result: ['cake', 'cookie', 'bread',
'biscuit', 'tart']
```

## Determining List Length with `len()`

The Python `len()` function can be used to determine the number of items found in the list it accepts as an argument.

```
knapsack = [2, 4, 3, 7, 10]
size = len(knapsack)
print(size)
# Output: 5
```

## List Method `.append()`

In Python, you can add values to the end of a list using the `.append()` method. This will place the object passed in as a new element at the very end of the list. Printing the list afterwards will visually show the appended value. This `.append()` method is *not* to be confused with returning an entirely new list with the passed object.

```
orders = ['daisies', 'periwinkle']
orders.append('tulips')
print(orders)
# Result: ['daisies', 'periwinkle',
'tulips']
```

## List Indices

Python list elements are ordered by *index*, a number referring to their placement in the list. List indices start at 0 and increment by one.
To access a list element by index, square bracket notation is used: `list[index]`.

```
berries = ["blueberry", "cranberry",
"raspberry"]

berries[0]   # "blueberry"
berries[2]   # "raspberry"
```

## Negative List Indices

Negative indices for lists in Python can be used to reference elements in relation to the end of a list. This can be used to access single list elements or as part of defining a list range. For instance:

- To select the last element, `my_list[-1]`.
- To select the last three elements, `my_list[-3:]`.
- To select everything except the last two elements, `my_list[:-2]`.

```
soups = ['minestrone', 'lentil', 'pho',
'laksa']
soups[-1]   # 'laksa'
soups[-3:]  # 'lentil', 'pho', 'laksa'
soups[:-2]  # 'minestrone', 'lentil'
```

## `sorted()` Function

The Python `sorted()` function accepts a list as an argument, and will return a new, sorted list containing the same elements as the original. Numerical lists will be sorted in ascending order, and lists of Strings will be sorted into alphabetical order. It does not modify the original, unsorted list.

```
unsortedList = [4, 2, 1, 3]
sortedList = sorted(unsortedList)
print(sortedList)
# Output: [1, 2, 3, 4]
```

## Zero-Indexing

In Python, list index begins at zero and ends at the length of the list minus one. For example, in this list, `'Andy'` is found at index `2`.

```
names = ['Roger', 'Rafael', 'Andy',
'Novak']
```

## List Slicing

A *slice*, or sub-list of Python list elements can be selected from a list using a colon-separated starting and ending point.
The syntax pattern is `myList[START_NUMBER:END_NUMBER]`. The slice will include the `START_NUMBER` index, and everything until but excluding the `END_NUMBER` item.
When slicing a list, a new list is returned, so if the slice is saved and then altered, the original list remains the same.

```
tools = ['pen', 'hammer', 'lever']
tools_slice = tools[1:3] # ['hammer',
'lever']
tools_slice[0] = 'nail'

# Original list is unaltered:
print(tools) # ['pen', 'hammer', 'lever']
```

## Function Parameters

Sometimes functions require input to provide data for their code. This input is defined using *parameters*. *Parameters* are variables that are defined in the function definition. They are assigned the values which were passed as arguments when the function was called, elsewhere in the code.
For example, the function definition defines parameters for a character, a setting, and a skill, which are used as inputs to write the first sentence of a book.

```
def write_a_book(character, setting,
special_skill):
  print(character + " is in " +
        setting + " practicing her " +
        special_skill)
```

## Multiple Parameters

Python functions can have multiple *parameters*. Just as you wouldn't go to school without both a backpack and a pencil case, functions may also need more than one input to carry out their operations.
To define a function with multiple parameters, parameter names are placed one after another, separated by commas, within the parentheses of the function definition.

```
def ready_for_school(backpack, pencil_case):
  if (backpack == 'full' and pencil_case == 'full'):
    print ("I'm ready for school!")
```

## Function Indentation

Python uses indentation to identify blocks of code. Code within the same block should be indented at the same level. A Python function is one type of code block. All code under a function declaration should be indented to identify it as part of the function. There can be additional indentation within a function to handle other statements such as `for` and `if` so long as the lines are not indented less than the first line of the function code.

```
# Indentation is used to identify code blocks

def testfunction(number):
  # This code is part of testfunction
  print("Inside the testfunction")
  sum = 0
  for x in range(number):
    # More indentation because 'for' has a code block
    # but still part of he function
    sum += x
  return sum
print("This is not part of testfunction")
```

## Function Arguments

*Parameters* in python are variables — placeholders for the actual values the function needs. When the function is *called*, these values are passed in as *arguments*.
For example, the arguments passed into the function `.sales()` are the "The Farmer's Market", "toothpaste", and "$1" which correspond to the parameters `grocery_store`, `item_on_sale`, and `cost`.

```
def sales(grocery_store, item_on_sale, cost):
  print(grocery_store + " is selling " + item_on_sale + " for " + cost)

sales("The Farmer's Market", "toothpaste", "$1")
```

## Returning Value from Function

A `return` keyword is used to return a value from a Python function. The value returned from a function can be assigned to a variable which can then be used in the program.
In the example, the function `check_leap_year` returns a string which indicates if the passed parameter is a leap year or not.

```
def check_leap_year(year):
  if year % 4 == 0:
    return str(year) + " is a leap year."
  else:
    return str(year) + " is not a leap year."

year_to_check = 2018
returned_value = check_leap_year(year_to_check)
print(returned_value) # 2018 is not a leap year.
```

## Parameters as Local Variables

Function parameters behave identically to a function's local variables. They are initialized with the values passed into the function when it was called.
Like local variables, parameters cannot be referenced from outside the scope of the function.
In the example, the parameter `value` is defined as part of the definition of `my_function`, and therefore can only be accessed within `my_function`.
Attempting to print the contents of `value` from outside the function causes an error.

```
def my_function(value):
  print(value)

# Pass the value 7 into the function
my_function(7)

# Causes an error as `value` no longer exists
print(value)
```